Department of Environmental Quality
Division of INL Oversight
and Radiation Control

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

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State of Idaho
Division of INL Oversight and Radiation Control

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Table of Acronyms

aCi/L - attocuries per liter
BEA - Battelle Energy Alliance, LLC
CERCLA - Comprehensive Environmental Response Compensation and Liability Act
CFA - Central Facilities Area
CWI - CH2M-WG Idaho, LLC
DEQ-INL - The State of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control
DOE - U.S. Department of Energy
EIC - electret ionization chamber
EML - Environmental Monitoring Laboratory
EPA - Environmental Protection Agency
ESER - Environmental Surveillance Education and Research Program (SM Stoller)
ESP - Environmental Surveillance Program
ESRPA - Eastern Snake River Plain Aquifer
HPIC - high-pressure ion chamber
LLD - lower limit of detection
IBL - Idaho Bureau of Laboratories
INL - Idaho National Laboratory
INTEC - Idaho Nuclear Technology and Engineering Center
LSC - liquid scintillation counting
MFC - Materials and Fuels Complex
µg/L - micrograms per liter
mg/L - milligrams per liter
mrem - millirem or 1/1000th of a rem
mR/hr - milliRoentgen per hour
µR/hr - microRoentgen per hour
MCL - maximum contaminate level
MDA - minimum detectable activity
MDC - minimum detectable concentration
NIST - National Institute of Standards and Technology
nCi/L - nanocuries per liter
NOAA - National Oceanic and Atmospheric Administration
NRF - Naval Reactors Facility
pCi/L - picocuries per liter
pCi/m^3 - picocuries per cubic meter
PM_{10} - particulate matter with aero-dynamic diameter less than or equal to 10 micrometers
PCE - perchloroethene
QAPP - Quality Assurance Program Plan
QA/QC - Quality Assurance/Quality Control
RCRA - Resource Conservation and Recovery Act
RPD - relative percent difference
RWMC - Radioactive Waste Management Complex
RTC - Reactor Technology Complex
SD - standard deviation
SMCL - secondary maximum contaminant level
TAN - Test Area North
TCE - trichloroethene
TDS - total dissolved solids
TMI - Three Mile Island
TSP - total suspended particulate
TSS - total suspended solids
USGS - U.S. Geological Survey
VOC - volatile organic compound
WLAP - Wastewater Land Application Permit

Introduction

The state of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control (DEQ-INL) Environmental Surveillance Program (ESP) is conducted at locations on the INL, on the boundaries of the INL, and at distant locations to the INL in accordance with accepted monitoring procedures and management practices. This program is designed to provide the people of the state of Idaho with independently evaluated information about the impacts of the Department of Energy's (DOE) activities in Idaho.

The primary objective for DEQ-INL's ESP is to maintain an independent environmental monitoring and verification program designed to verify and supplement DOE's data and programs. This program is also used to provide the citizens of Idaho with information that has been independently evaluated to enable them to reach informed conclusions about DOE activities in Idaho and potential impacts to public health and the environment.

Results of the ESP are published using two distinct reporting formats: quarterly data reports and an annual ESP report. The annual ESP report is designed for a more broad audience and summarizes the results of the ESP for the previous four quarters. The annual report's primary emphasis is to focus on trends, ascertain the impacts of DOE operations on the environment, and confirm the validity of DOE monitoring programs. This quarterly report is designed to provide the mechanism to document the results of the ESP on a quarterly basis and provide detailed data to those who wish to "see the numbers." It is organized according to the media sampled and also provides a quality assurance assessment.

Air and Precipitation Monitoring Results

The ESP operated eight air monitoring stations on and near the INL as well as two monitoring stations distant from the INL during the first quarter, 2006 (**Figure 1**). These stations employed instrumentation for collecting airborne particulate matter, gaseous radioiodine, precipitation, and water vapor for tritium analysis (**Table 1**). The Shoshone-Bannock Tribes operated an air monitoring station located at Fort Hall. The Fort Hall station uses identical instrumentation and sampling protocol as the ten stations operated by the ESP. The DEQ-INL reports the Fort Hall station data as an additional background site.

Airborne particulate matter was sampled using high-volume total suspended particulate (TSP) air samplers. Weekly gross alpha and gross beta particulate radioactivity results for filters from the TSP samplers are presented in **Appendix A** and summarized in **Table 2**. Gross alpha and gross beta radioactivity concentrations reported from the particulate samples were within the range of expected values for naturally occurring radioactivity observed historically.

Composites of filters collected using TSP samplers during the course of a calendar quarter were analyzed using gamma spectroscopy. Typically, gamma spectroscopy results were only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC). Gamma spectroscopy results for the first quarter of 2006 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

No radioactive isotopes of iodine, specifically iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the first quarter.

Atmospheric moisture was collected by drawing air through hydroscopic media at each of the eleven monitoring stations. This moisture was stripped from the hydroscopic media and analyzed to calculate the atmospheric tritium concentration. Reported values are the result of either a single sample or a

weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. No atmospheric tritium was measured at any sampling locations during the first quarter of 2006. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the first quarter of 2006.

Precipitation samples were analyzed for tritium and gamma-emitting radionuclides. Tritium and gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the first quarter of 2006. Tritium and cesium-137 analysis results are presented in **Table 5**. Reported values were either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter.

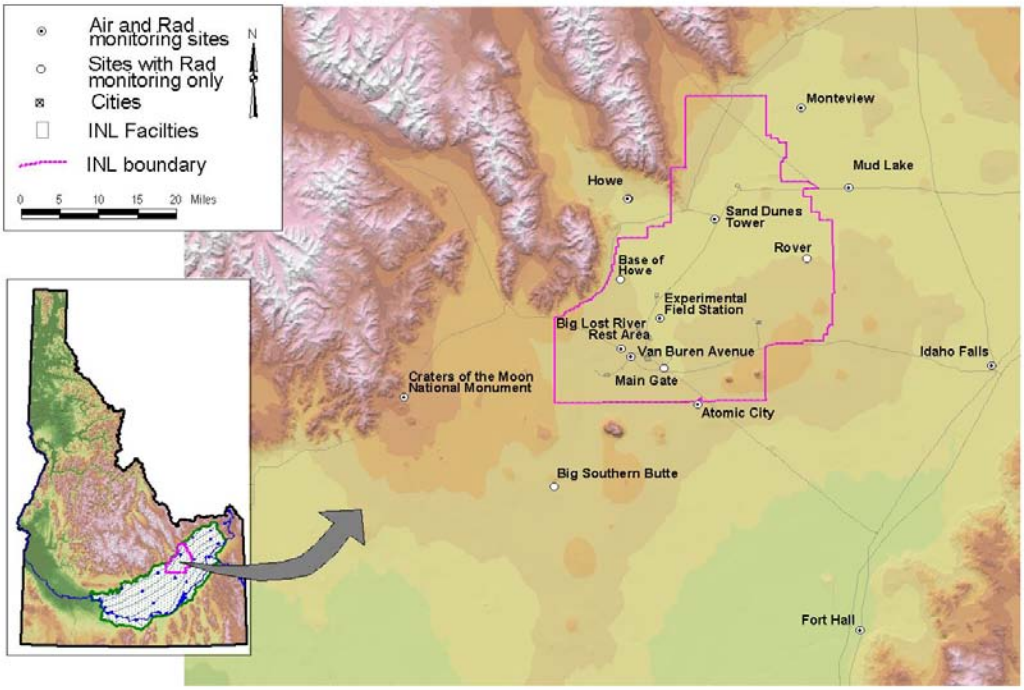

Figure 1. Air and radiation monitoring sites.

Table 1. Sampling locations and sample type.

Station Locations	Sample type[1]			
	TSP	Radioiodine	Water Vapor	Precipitation
On-site Locations				
Big Lost River Rest Area	□	□	■	■
Experimental Field Station	□	□	■	
Sand Dunes Tower	□	□	■	
Van Buren Avenue	□	□	■	
Boundary Locations				
Atomic City	□	□	■	■
Howe	□	□	■	■
Monteview	□	□	■	■
Mud Lake	□	□	■	■
Distant Locations				
Craters of the Moon	□	□	■	
Fort Hall[2]	□	□	■	
Idaho Falls	□	□	■	■

[1] □ Samples collected weekly; ■ Samples collected quarterly.
[2] TSP and radioiodine samples collected by Shoshone-Bannock Tribes.

Table 2. Range of alpha and beta concentrations for TSP filters, first quarter, 2006. Concentrations are reported in 1x 10^{-3} pCi/m^3.

Station Location	Concentration	
	Gross Alpha	Gross Beta
On-Site Locations		
Big Lost River Rest Area	0.0 - 0.8	6.5 - 43.5
Experimental Field Station	0.0 - 1.0	6.3 - 53.0
Sand Dunes Tower	0.0 - 0.9	6.7 - 51.3
Van Buren Avenue	0.1 - 0.9	6.7 - 43.5
Boundary Locations		
Atomic City	-0.1 - 0.9	6.6 - 37.6
Howe	0.0 - 1.1	5.9 - 48.3
Monteview	0.1 - 1.0	7.0 - 45.1
Mud Lake	0.1 - 1.3	6.1 - 45.4
Distant Locations		
Craters of the Moon	-0.2 - 1.0	4.5 - 32.0
Fort Hall[1]	0.3 - 1.6	5.2 - 27.2
Idaho Falls	0.1 - 1.1	5.9 - 35.6

[1] Operated by Shoshone-Bannock Tribes.

Table 3. Gamma spectroscopy analysis data of TSP filters, composite sample, first quarter, 2006. Concentrations are reported in 1 x 10^{-3} pCi/m^3 with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar quarter.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
On-site Locations			
Big Lost River Rest Area	61.8	3.4	<MDC
Experimental Field Station	55.7	3.2	<MDC
Sand Dunes Tower	60.9	3.3	<MDC
Van Buren Avenue	55.8	3.1	<MDC
Boundary Locations			
Atomic City	60.6	3.3	<MDC
Howe	54.9	3.1	<MDC
Monteview	53.4	3.0	<MDC
Mud Lake	58.6	3.3	<MDC
Distant Locations			
Craters of the Moon	56.6	3.2	<MDC
Fort Hall[1]	54.1	3.0	<MDC
Idaho Falls	59.4	3.3	<MDC

[1] Operated by Shoshone-Bannock Tribes.

Table 4. Tritium concentrations from atmospheric moisture, first quarter, 2006. Concentrations are reported in pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.04	0.08	0.14
Experimental Field Station	0.06	0.08	0.13
Sand Dunes Tower	0.04	0.08	0.13
Van Buren Avenue	0.12	0.08	0.13
Boundary Locations			
Atomic City	0.05	0.08	0.13
Howe	0.03	0.08	0.13
Mud Lake	0.08	0.08	0.14
Monteview	-0.01	0.08	0.14
Distant Locations			
Craters of the Moon	0.04	0.08	0.13
Fort Hall	0.01	0.08	0.14
Idaho Falls	0.03	0.08	0.13

Table 5. Tritium and cesium-137 concentrations from precipitation, first quarter, 2006. Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	5	90	145	-0.5	1.3	2.4
Boundary Locations						
Atomic City	45	90	140	0.6	1.6	2.6
Howe	45	90	145	0.0	1.6	2.9
Monteview	55	90	145	-0.5	1.6	2.8
Mud Lake	76	90	145	0.3	1.4	2.4
Distant Locations						
Idaho Falls	3	90	145	0.2	1.8	3.1

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the first quarter of 2006 **(Figure 1)**. To detect gamma radiation, each station is instrumented with an electret ionization chamber (EIC), and 11 of the stations also have high-pressure ion chambers (HPIC) **(Table 6)**. The Shoshone-Bannock Tribes operate an additional environmental radiation station at Fort Hall equipped with both an EIC and HPIC. The DEQ-INL reports these results.

HPICs are instruments capable of real-time measurements, and are sensitive enough to detect small changes in gamma radiation levels. The real-time gamma radiation measurements collected by the HPICs at each location are radioed to DEQ-INL and presented graphically via the worldwide web at www.idahoop.org. EICs are a passive-integrating system that provides a cumulative measure of environmental gamma radiation exposure in the field. Typically, EICs are deployed, collected and analyzed quarterly. DEQ-INL compared the exposure rates measured by EICs and HPICs and observed that the data correlated very well from both measurement methods; although, EICs tend to over respond by approximately 20 percent, accounting for the slight differences observed between the two measurements. A complete analysis of the radiation measuring devices can be found in *A Comparison of Three Methods for Measuring Environmental Radiation*, Moser, Kristi, Idaho State University, M.S. Thesis, 2002. Each system is used by DEQ-INL to measure gamma radiation for various radiological monitoring objectives. EICs offer an inexpensive methodology to measure gamma radiation over a wide area, particularly in regions which do not have a power source. EICs can also provide valuable gamma radiation data in the event of an emergency. It is because of this reason that EICs are also deployed at 78 locations by DEQ-INL in a widespread network around the INL measuring general background radiation. This information is tabulated in **Appendix B.**

Table 7 lists the average radiation exposure rates measured by the HPICs for first quarter. Exposure rates were within the expected historical range of values observed by DEQ-INL for background radiation. **Table 8** lists the EIC monitoring results for first quarter.

Table 6. Summary of instrumentation at radiation monitoring stations.

Station Location	Instrument Type	
	HPIC	EIC
On-site Locations		
Base of Howe	■	■
Big Lost River Rest Area	■	■
Experimental Field Station		■
Main Gate	■	■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
Boundary Locations		
Atomic City	■	■
Big Southern Butte	■	■
Howe	■	■
Monteview	■	■
Mud Lake	■	■
Distant Locations		
Craters of the Moon		■
Fort Hall[1]	■	■
Idaho Falls	■	■

[1] HPIC operated by Shoshone-Bannock Tribes with the EIC maintained by DEQ-INL.

Table 7. Average gamma exposure rates for first quarter, 2006, from HPIC network. These rates are expressed in µR/hr.

	Exposure Rate	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	10.9	1.1
Big Lost River Rest Area	16.0	1.5
Main Gate	12.8	1.0
Rover	12.3	1.1
Sand Dunes Tower	12.9	1.0
Boundary Locations		
Atomic City	11.0	1.1
Big Southern Butte	10.0	1.0
Howe	12.5	2.9
Monteview	10.8	0.9
Mud Lake	11.0	0.9
Distant Locations		
Fort Hall[1]	10.9	1.0
Idaho Falls	11.4	0.8

[1] Operated by Shoshone-Bannock Tribes.

Table 8. Electret ionization chamber (EIC) cumulative average exposure rates for first quarter, 2006. These rates are expressed in µR/hr.

Station Location	Exposure Rate	
	Total	± 2 SD
On-site Locations		
Base of Howe	12.8	1.3
Big Lost River Rest Area	15.5	2.9
Experimental Field Station	15.3	2.6
Main Gate	12.6	5.3
Rover	14.9	3.7
Sand Dunes Tower	12.7	4.0
Van Buren Avenue	14.8	3.8
Boundary Locations		
Atomic City	10.2	1.6
Big Southern Butte	18.8	10.2
Howe	12.5	2.1
Monteview	14.3	2.1
Mud Lake	11.4	1.1
Distant Locations		
Craters of the Moon	10.6	1.3
Fort Hall	11.7	4.5
Idaho Falls	10.0	0.7

Water Monitoring

Water monitoring sites are sampled for the purposes of examining trends of INL contaminants and other general ground water quality indicators and for verifying DOE monitoring results. Sites sampled include ground water locations (wells and springs), surface water locations (streams), and selected waste water sites. Sample sites have been selected to aid in identifying INL impacts on the Eastern Snake River Plain Aquifer (ESRPA), and are categorized as up-gradient, facility, boundary, distant, surface water, and waste water, **(Figures 2 and 3)**. Up-gradient locations are not impacted by INL operations and are considered representative of background ground water quality conditions. Facility sites are sample locations on the INL near facilities, in areas of known contamination, or wells selected to illustrate trends for specific INL contaminants or indicators of ground water quality. Boundary locations are on or near the perimeter of the INL or are down-gradient of potential sources of INL contamination. Distant locations are monitored to provide trends in water quality down-gradient of the INL and include wells and springs used for irrigation, public water supply, livestock, domestic, and industrial purposes. During the first quarter of 2006, one up-gradient location, seven facility locations, one boundary location, and five distant locations were sampled.

Sites sampled by DEQ-INL are sampled with another agency or organization. Samples are collected at about the same time using the same collection equipment as the other agency or organization (co-sampled). DEQ-INL verifies work by these agencies monitoring on behalf of DOE by comparing results from co-sampled sites.

Gross alpha and gross beta analyses are conducted as a screening tool for alpha and beta emitting radionuclides potentially released due to INL operations. Selected sites are sampled for the man-made,

alpha emitting isotopes of plutonium, uranium, americium, and neptunium; and beta emitting radionuclides technetium-99 and strontium-90, based on historic INL contamination. In the event of suspect or unexpected levels of gross radioactivity, additional samples may also be analyzed for other specific radionuclides.

Gross alpha radioactivity was detected in two of the three facility locations and ranged from 3.9 ± 2.2 to 7.8 ± 2.7 pCi/L. There were no detections in up-gradient, boundary, or distant samples. The EPA maximum contaminant level (MCL) for alpha particles in 15 pCi/L. Gross beta radioactivity was detected in all of the samples. The up-gradient site result was 4.2 ± 1.0 pCi/L, facility sites ranged from 4.5 ± 1.0 to 162.3 ± 3.1 pCi/L, the boundary site was 3.6 ± 1.0 pCi/L, and distant sites ranged from 1.9 ± 1.0 to 5.7 ± 1.2 pCi/L. Background concentrations of gross alpha and gross beta radioactivity in the ESPRA range from 0 to 3 and 0 to 8 pCi/L as established *in Background Concentrations of Selected Radionuclides, Organic Compounds and Chemical Constituents in Groundwater in the Vicinity of the Idaho National Engineering Laboratory*, (Orr and others, 1991). The derived MCL for beta radioactivity is 8 pCi/L if the source of the radioactivity is strontium-90; 900 pCi/L if technetium-99; or 20,000 pCi/L if tritium. The concentrations of gross alpha and gross beta radioactivity were consistent with historical results and were within expected ranges. No man-made, gamma emitting radionuclides were identified via gamma spectroscopic analysis. Results for gross alpha, gross beta, and man-made, gamma emitting radioactivity are shown in **Table 9.**

Both of the two facility locations sampled for strontium-90 had detectable results and ranged from 0.18 ± 0.089 to 23.4 to 5.5 pCi/L (**Table 10**). The concentrations are consistent with historical trends.

Three facility locations were sampled for technetium-99. Two of the three had detectable concentrations and ranged from 4.9 ± 0.2 to 271.3 ± 1.2 pCi/L (**Table 11**). Concentrations are consistent with historical trends.

Two facility locations were sampled for isotopes of uranium, plutonium, americium, and neptunium. Both locations had detectable uranium results and ranged from 1.24 ± 0.31 to 1.76 ± 0.41 pCi/L for uranium-234, from 0.118 ± 0.085 to 0.121 ± 0.086 pCi/L for uranium-235, and from 0.57 ± 0.19 to 0.76 ± 0.23 pCi/L for uranium-238. These results cannot be distinguished from background concentrations. There were no detectable results for plutonium-238, 239/240 and 241; americium-241 and neptunium-237 (**Tables 12-15**).

Using the standard analytical method, tritium was detected in all seven of the samples from facility locations and ranged from 1,050 ± 81 to 4100 ± 180 pCi/L, well below the MCL of 20,000 pCi/L. There were no detectable concentrations in samples from up-gradient, boundary, or distant sites(**Table 16**) . Water samples with tritium concentrations not measurable using the standard method (typically a MDC of 130 pCi/L) are analyzed using an electrolytic enrichment method with a much lower MDC of 10 to 14 pCi/L (**Table 17**). Using the electrolytic method, tritium was detected in two of the five distant samples and ranged from 18 ± 8 to 27 ± 7 pCi/L. These concentrations are within the expected range due to a combination of natural sources and the levels remaining after the atomic bomb testing era. There were no detections in either the up-gradient or boundary samples.

Samples from three facility sites were also analyzed for metals and the results are shown in **Table 18.** The following discussion of metals results only applies to detectable concentrations. Each of these facility locations are in areas of known contamination and within their expected ranges. Barium results ranged from 51 to 88 µg/L, well below the MCL of 2,000 µg/L. Chromium results ranged from 6 to 180 µg/L, with a MCL of 100 µg/L. Concentrations above approximately 5 µg/L are indicative of INL contamination based on DEQ-INL historic sample results. Iron results ranged from 20 to 1,800 µg/L, and has a secondary maximum contaminant level (SMCL) of 300 µg/L. Manganese results ranged from 83 to

84 µg/L, with a SMCL of 50 µg/L. Zinc results ranged from 11 to 62 µg/L, well below the SMCL of 5,000 µg/L.

Common ions results for three facility sites are shown in **Table 19**. All results are within their expected ranges, depending on sample location and extent of contamination in specific areas. Calcium results ranged from 43 to 55 mg/L. Magnesium results range from 14 to 15 mg/L. Sodium results ranged from 11 to 16 mg/L. Potassium results ranged from 2.4 to 3.1 mg/L. Fluoride results ranged from 0.296 to 0.308 mg/L. Chloride results ranged from 22.7 to 26.5 mg/L. Sulfate results ranged from 21.4 to 25.8 mg/L. The one result for silica was 22 mg/L. Alkalinity results ranged from 127 to 145 mg/L. The one result for TDS was 250 mg/L.

Nutrient results for the three facility sites are shown in **Table 20.** Nitrite plus nitrate as nitrogen concentrations ranged from1.0 to 3.2 mg/L. Nitrogen concentrations of more than 1-2 mg/L are indicative of anthropogenic contamination. Total phosphorous ranged from 0.03 to 0.06 mg/L. There was only one result for TKN (0.06 mg/L).

Volatile Organic Compounds (VOCs) with detectable concentrations are shown in **Table 21**. The background concentrations for VOCs should be zero. The results discussed in this section only refer to detectable concentrations. 1,1-Dichloroethene ranged from 0.19 to 3.0 µg/L. cis-1,2-Dichloroethene ranged from 4.9 to 71 µg/L. trans-1,2-Dichloroethene ranged from 1.9 to 42. µg/L. Tetrachloroethylene (PERC) ranged from 14 to 20 µg/L. 1,1,1-Trichloroethane (TCA) ranged from 0.35 to 2.2 µg/L. Trichloroethylene (TCE) ranged from 160 to 620 µg/L. Vinyl chloride ranged from 0.31 to 1.1 µg/L. Chloroform ranged from 0.33 to 0.79 µg/L. 1,1-Dichloroethane had one result of 1.1 µg/L. The MCLs were exceeded for trichloroethylene (5 µg/L), and cis-1,2-dichloroethene (70 µg/L). All of the locations monitored for VOCs are within an area of known contamination.

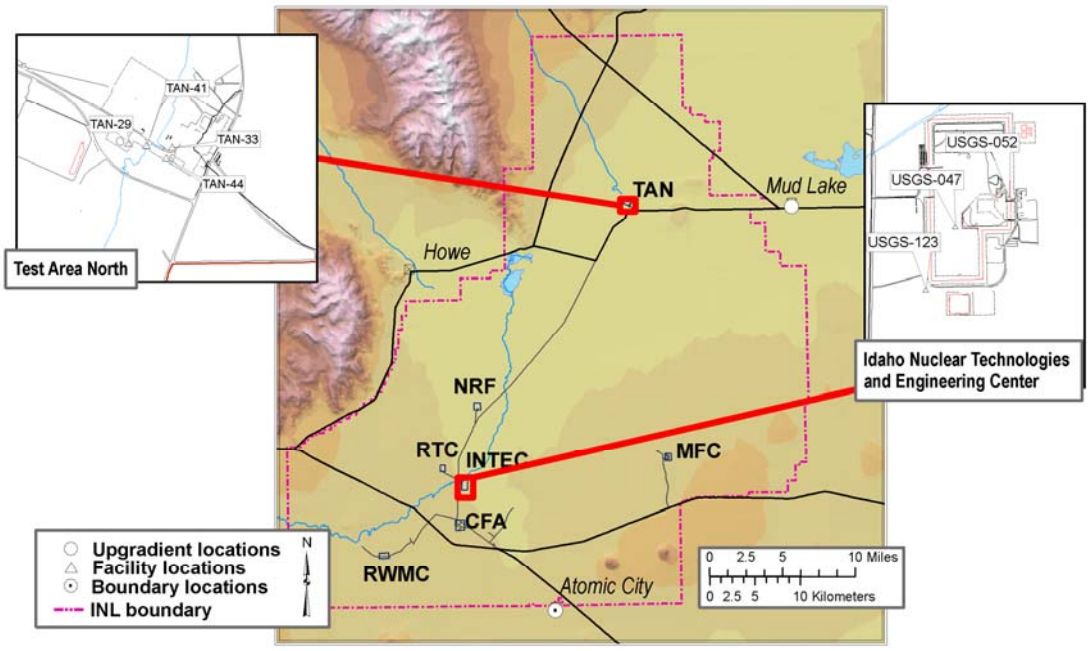

Figure 2. Facility water monitoring locations for first quarter, 2006.

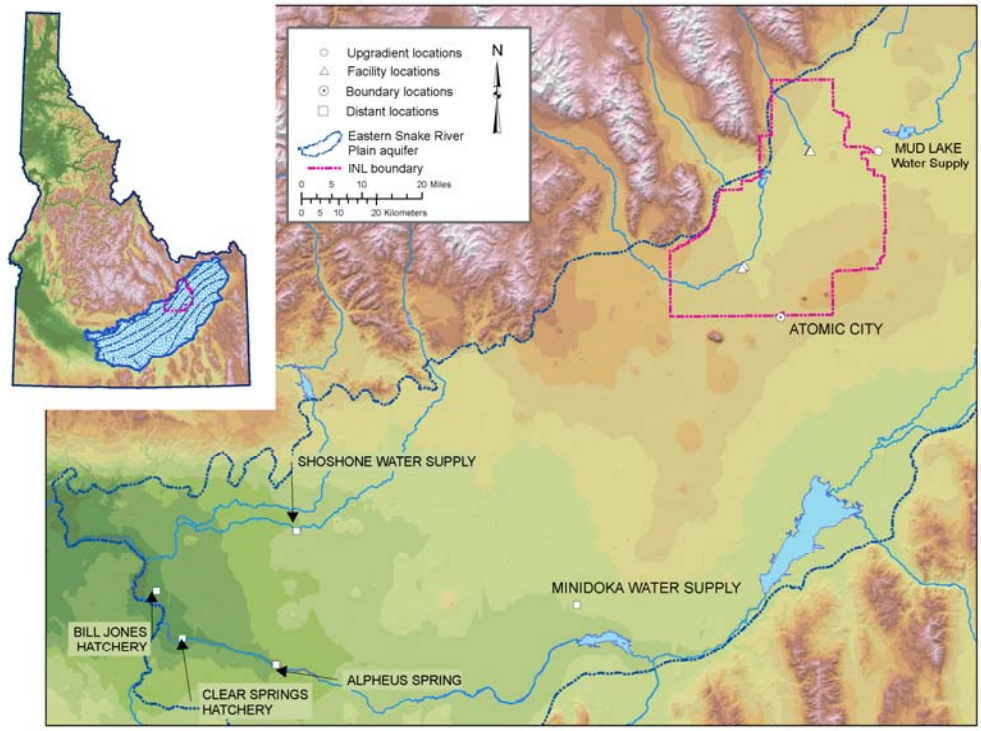

Figure 3. Water monitoring locations for first quarter, 2006.

Table 9. Alpha, beta, and gamma concentrations[1] for water samples, first quarter, 2006. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Gross Alpha		Gross Beta		Man-made gamma-emitting radionuclide Cesium-137
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration
Up-gradient						
Mud Lake Water Supply	2/10/06	-0.4 U	1.4	4.2	1.0	<MDC
Facility						
USGS-047	3/8/06	3.2 U	2.3	64.4	2.0	<MDC
USGS-052	3/8/06	7.8	2.7	162.3	3.1	<MDC
USGS-123	3/7/06	3.9	2.2	4.5	1.0	
Boundary						
Atomic City	2/8/06	1.7 U	2.0	3.6	1.0	<MDC
Distant						
Alpheus Spring	2/7/06	0.7 U	2.7	5.7	1.2	<MDC
Bill Jones Hatchery	2/7/06	-0.5 U	1.8	3.3	1.0	<MDC
Clear Spring	2/7/06	3.2 U	2.5	4.7	1.1	<MDC
Minidoka Water Supply	2/7/06	-0.4 U	2.3	2.9	1.0	<MDC
Shoshone Water Supply	2/7/06	0.7 U	1.9	1.9	1.0	<MDC

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. <MDC – Less than minimum detectable concentration for analysis by gamma spectroscopy.

Table 10. Reported concentrations[1] of strontium-90 in water samples, first quarter, 2006. Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Strontium-90	
		Concentration	± 2 SD
Facility			
USGS-047	3/8/06	23.4	5.5
USGS-123	3/7/06	0.18	0.089

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 11. Reported concentrations[1] of dissolved technetium-99 in water samples, first quarter, 2006. Concentrations are expressed in pCi/L. Samples were filtered.

Sample Location	Sample Date	Technetium-99		
		Concentration		± 2 SD
Facility				
USGS-047	3/8/06	4.9		0.2
USGS-052	3/8/06	271.3		1.2
USGS-123	3/7/06	0.2	U	0.2

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 12. Reported concentrations[1] of total plutonium-238, plutonium-239/240, and plutonium-241 in water samples, first quarter, 2006. Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Plutonium-238		Plutonium-239/240		Plutonium-241	
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration	± 2 SD
Facility							
USGS-047	3/8/06	-0.005 U	0.03	0.006 U	0.029	-0.2 U	4.4
USGS-123	3/7/06	0 U	0.028	0 U	0.028	-0.9 U	4.1

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected

Table 13. Reported concentrations[1] of total uranium-234, uranium-235, and uranium-238 in water samples, first quarter, 2006. Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Uranium-234		Uranium-235		Uranium-238	
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration	± 2 SD
Facility							
USGS-047	3/8/06	1.76	0.41	0.121	0.086	0.76	0.23
USGS-123	3/7/06	1.24	0.31	0.118	0.085	0.57	0.19

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 14. Reported concentrations[1] of americium-241 in water samples, first quarter, 2006. Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Americium-241	
		Concentration	±2 SD
Facility			
USGS-047	3/8/06	0.02 U	0.016
USGS-123	3/7/06	0.017 U	0.014

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 15. Reported concentrations[1] of neptunium-237 in water samples, first quarter, 2006. Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Neptunium-237	
		Concentration	±2 SD
Facility			
USGS-047	3/8/06	0.01 U	0.037
USGS-123	3/7/06	-0.007 U	0.045

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 16. Tritium concentrations[1] for water samples, first quarter, 2006. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
Up gradient Locations			
Mud Lake Water Supply	2/10/06	-20 U	80
Facility			
TAN-29	1/18/06	1800	130
TAN-33	1/18/06	1050	81
TAN-41	1/18/06	2130	140
TAN-44	1/18/06	1930	140
USGS-047	3/8/06	1850	130
USGS-052	3/8/06	2360	140
USGS-123	3/7/06	4100	180
Boundary Locations			
Atomic City	2/8/06	0 U	80
Distant Locations			
Alpheus Spring	2/7/06	-30 U	80
Bill Jones Hatchery	2/7/06	-10 U	80
Clear Spring	2/7/06	20 U	80
Minidoka Water Supply	2/7/06	-40 U	80
Shoshone Water Supply	2/7/06	110 U	90

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 17. Enriched tritium concentrations[1] for water samples, first quarter, 2006. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
Up gradient Locations			
Mud Lake Water Supply	2/10/06	1 U	5
Boundary Locations			
Atomic City	2/8/06	9 U	6
Distant Locations			
Bill Jones Hatchery	2/7/06	6 U	6
Clear Spring	2/7/06	11 U	8
Minidoka Water Supply	2/7/06	9 U	6
Shoshone Water Supply	2/7/06	18	8
Alpheus Spring	2/7/06	27	7

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 18. Reported metals concentrations[1] in water samples, first quarter, 2006. Concentrations are expressed in µg/L. Samples are not filtered (total) unless otherwise indicated. NR = analysis not requested.

Sample Location	Sample Date	Concentration										
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Iron	Manganese	Mercury	Selenium	Zinc
Facility												
USGS-047	3/8/06	<5 U	69	<1 U	<1 U	6	90	<5 U	84	<0.5 U	<10 U	62
USGS-052	3/8/06	<5 U	88	<1 U	<1 U	6	20	<5 U	<2 U	<0.5 U	<10 U	<5 U
USGS-123	3/7/06	<5 U	51	<1 U	<1 U	180	1800	<5 U	83	<0.5 U	<10 U	11

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.

Table 19. Reported common ions concentrations[1] for the water samples, first quarter, 2006. Concentrations are expressed in mg/L. Samples are not filtered (total) unless otherwise indicated. NR = Analysis not requested.

Sample Location	Sample Date	Concentration										
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity[2]	Silica	TDS[3]	TSS[4]
Facility												
USGS-047	3/8/06	55	14	14	2.4	0.296	23.9	24.6	NR	127	NR	NR
USGS-052	3/8/06	52	15	16	3.1	0.308	26.5	25.8	22	145	250	<2 U
USGS-123	3/7/06	43	15	11	3.1	0.305	22.7	21.4	NR	129	NR	NR

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.
[2] As $CaCo_3$.
[3] Dissolved nitrate + nitrite as N.
[4] Dissolved phosphorus as P.

Table 20. Total nutrient concentrations[1] of unfiltered water samples collected for verification purposes during the first quarter, 2006. Concentrations are expressed in mg/L. Samples are not filtered (total) unless otherwise indicated. NR = Analysis not requested. NR = Analysis not requested.

Sample Location	Sample Date	Concentration				
		Nitrite + Nitrate	Ammonia	Total Kjeldahl Nitrogen	Nitrite	Phosphorous
Facility						
USGS-047	3/8/06	3.0	NR	NR	NR	0.038
USGS-052	3/8/06	3.2	NR	0.06	NR	0.03
USGS-123	3/7/06	1.0	NR	NR	NR	0.06

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration

Table 21. Volatile organic compound (VOC) concentrations[1] for water samples, first quarter, 2006. Concentrations are expressed in µg/L.

Sample Site/Analyte	Result	MDL	MCL
TAN 29			
1,1-Dichloroethene	0.92	0.5	7
cis-1,2-Dichloroethene	71.0	1.0	70
trans-1,2-Dichloroethene	42.0	1.3	100
Tetrachloroethylene (PERC)	17.0	0.5	5
Trichloroethylene (TCE)	620.0	3.5	5
Vinyl chloride	1.1	0.2	2
Chloroform	0.39	0.5	
TAN 33			
1,1-Dichloroethene	3.0	0.5	7
cis-1,2-Dichloroethene	4.9	0.5	70
trans-1,2-Dichloroethene	1.9	0.5	100
Tetrachloroethylene (PERC)	19.0	0.5	5
1,1,1-Trichloroethane (TCA)	2.2	0.5	200
Trichloroethylene (TCE)	160	0.7	5
Chloroform	0.79	0.25	
TAN 41			
1,1-Dichloroethene	0.84	0.5	7
cis-1,2-Dichloroethene	18.0	0.5	70
trans-1,2-Dichloroethene	19.0	0.5	100
Tetrachloroethylene (PERC)	20.0	0.5	5
1,1,1-Trichloroethane (TCA)	0.35	0.23	200
Trichloroethylene (TCE)	250.0	0.7	5
Vinyl chloride	0.31	0.2	2
Chloroform	0.32	0.5	
1,1-Dichloroethane	1.1	0.5	
TAN 44			
1,1-Dichloroethene	0.79	0.5	7
cis-1,2-Dichloroethene	10.0	0.5	70
trans-1,2-Dichloroethene	2.4	0.5	100
Tetrachloroethylene (PERC)	14.0	0.5	5
1,1,1-Trichloroethane (TCA)	0.52	0.5	200
Trichloroethylene (TCE)	220	0.7	5
Chloroform	0.33	0.5	

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. DL – Detection Limit. NA – Not Applicable.

Terrestrial Monitoring Results

The ESP conducts terrestrial (soil and milk) monitoring and verification to provide an indication as to the long-term deposition and migration of contaminants in the environment, and to provide independent verification of DOE's analytical measurement of terrestrial variables.

Results for analyses of milk samples, which are collected monthly, are presented in **Table 22**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131, a man-made radionuclide, was not detected.

No soil samples were analyzed this quarter.

Table 22. Gamma spectroscopy analysis data for milk samples, first quarter, 2006. Concentrations are expressed in pCi/L.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40		Man-made gamma-emitting radionuclide Iodine-131[1]
		Concentration	± 2 SD	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	01/10/06	1472	100	<MDC
	02/07/06	1356	109	<MDC
	03/06/06	1342	106	<MDC
Mud Lake/Nelson-Ricks Creamery	01/10/06	1371	111	<MDC
	02/07/06	1498	113	<MDC
	03/06/06	1426	112	<MDC
Rupert-Minidoka/Kraft	01/10/06	1509	102	<MDC
	02/07/06	1432	99	<MDC
	03/07/06	1558	105	<MDC
Gooding/Glanbia	01/10/06	1342	109	<MDC
	02/07/06	1368	107	<MDC
	03/06/06	1274	106	<MDC
Verification Samples[2]				
Dietrich	02/07/06	1392	111	<MDC
Moreland	01/03/06	1480	112	<MDC
Moreland	03/07/06	1530	104	<MDC
Roberts	01/03/06	1438	113	<MDC
Roberts	03/07/06	1521	114	<MDC
Terreton	02/07/06	1513	102	<MDC

[1] <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for Iodine-131).
[2] DEQ-INL samples collected by the off-site INL environmental surveillance contractor.

Quality Assurance

The measurement of any physical quantity is subject to uncertainty from errors that may be introduced during sample collection, measurement, calibration, and the reading and reporting of results. While the sum of these inaccuracies cannot be quantified for each analytical result, a quality assurance program can evaluate the overall quality of a data set and possibly identify and address errors or inaccuracies.

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the first quarter of 2006 for the DEQ-INL's ESP. It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for nonradiological analyses and to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses during the quarter. All analyses and QC measures at the analytical laboratories used by the ESP are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL.

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the first quarter of 2006, the DEQ-INL submitted 55 QC samples for various radiological and nonradiological analyses (**Table 23**).

Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or unmeasurable amounts of the analyte(s) of interest in them. They are designed to determine if analyses will provide a "zero" result when no contaminant is expected to be present or an acceptable measure of "background," and therefore monitor any bias that may have been introduced during sample collection, storage, shipment, and analysis. Blank sample results submitted for gross alpha and gross beta screening in air for the first quarter of 2006 are presented in **Table 24**. Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 25**. Blank analysis results for radiochemical analysis data for TSP particulate air filters composited for 2005 are contained in **Table 26.** Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 27**. Blank analyses results for cesium-137, tritium, enriched tritium, gross alpha, and gross beta in ground and surface water media are presented in **Table 28.**

No anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL for the first quarter of 2006.

Duplicate Samples

Duplicate samples are collected in a manner such that the samples are thought to be essentially identical in composition and are used to assess analytical precision. The difference between the original sample and the duplicate sample is expressed as a relative percent difference (RPD) and is used to measure a laboratory's ability to reproduce consistent results. For radiological analyses, the standard deviation of the differences can be used as an indicator of the overall precision of the data set. Duplicate results for ground and surface water are presented in **Table 29** for radiological analyses.

No anomalies were observed from the assessment of field duplicate samples as measured by the analytical laboratories used by DEQ-INL for the first quarter of 2006.

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added in order to assess the bias a laboratory may have in accurately measuring these analytes. To determine agreement after laboratory analysis, DEQ-INL calculates the difference between the known concentration in the sample and the measured concentration by the laboratory. This result is known as percent recovery (%R) and the acceptable range used by DEQ-INL is 100 ± 25 percent. During first quarter 2006, no field matrices were spiked to assess the influence of the sample media on laboratory performance.

DEQ-INL also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL irradiates a number of electret ionization chambers (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and a "blind" exposure ranging from 20 to 50 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement agrees within 25 percent of the known irradiated quantity. The irradiation results for first quarter of 2006 are presented in **Table 30.** Although all results are within accepted ranges, a pattern of biased high spike results continues to be seen and is currently under investigation by DEQ-INL in cooperation with the vendor (RadElect) and ISU-EML. Results of the investigation are expected to be included in the second quarter 2006 data report.

No anomalies other than those listed above were observed from the assessment of spiked samples as measured by DEQ-INL or the analytical laboratories used by DEQ-INL for the first quarter of 2006.

Analytical QA/QC Assessment

No issues involving sample chain of custody, sample holding times, the analysis of blank, and duplicate samples were observed during the first quarter of 2006 which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL during the first quarter of 2006.

Data usability is the measure of data that is not rejected compared to the amount that was expected to be obtained. The overall data usability rate for the first quarter of 2006 met the minimum criteria of the DEQ-INL ESP and is summarized is **Table 23.**

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the first quarter of 2006 is summarized in **Table 31**. The TSP air sampler pump at the Experimental Field Station failed and was replaced. This failure resulted in an overall 92 percent operation rate for the TSP sampler at this location for the first quarter of 2006.

Conclusion

All data collected for the first quarter of 2006 have been assigned the applicable qualifiers to designate the appropriate use of the data. In addition, all data has been verified and deemed complete with the exception of three samples outstanding, meeting the requirements and data quality objectives established by DEQ-INL.

Table 23. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL ESP for first quarter, 2006.

Media Sampled	Collection Device	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
AIR								
Particulate	4 inch filter	Gross alpha	142	13	0	0	0	ISU-EML
		Gross beta	142	13	0	0	0	ISU-EML
		Gamma emitters	11	1	0	0	0	ISU-EML
		Radiochemical	11	1	0	0	0	ISU Sub
Particulate	Desiccant column	Tritium	22	5	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	12	0	0	0	0	ISU-EML
		Gamma emitters	11	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	10	1	1	0	0	ISU-EML
		Gross beta	10	1	1	0	0	ISU-EML
		Gamma emitters	10	1	1	0	0	ISU-EML
		Tritium	14	1	1	0	0	ISU-EML
		Enriched tritium	7	1	1	0	0	ISU-EML
		Technetium-99	3	0	0	0	0	ISU-EML
		Radiochemical[3]	12	0	0	0	0	ISU Sub
		Metals	3	0	0	0	0	IBL
		Common Ions	3	0	0	0	0	IBL
		Nutrients	3	0	0	0	0	IBL
		Volatile Organics	4	0	0	0	0	IBL Sub
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	18	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	0	0	0	0	0	DEQ-INL
	Grab – "puck"	Gamma emitters	0	0	0	0	0	ISU-EML
RADIATION								
Ambient	EICs	Gamma Radiation	93	4	0	8	0	DEQ-INL
	HPICs	Gamma Radiation	NA	NA	NA	NA	NA	DEQ-INL
Total Analyses			554	42	5	8	0	
Total of QC Analyses (blanks, duplicates, and spikes)						55		
Percentage of QC analyses of total analyses[4]						9.9		
Percentage of usable data[5]						100		

[1] Combined Laboratory and DEQ-INL rejection criteria (data was rejected for any reason).
[2] ISU-EML = Idaho State University – Environmental Monitoring Laboratory; ISU Sub = Subcontract laboratory to ISU-EML; IBL = Idaho Bureau of Laboratories, Boise; IBL Sub = Subcontract laboratory to IBL; DEQ-INL = Analyzed by INEEL Oversight and Radiation Control, Idaho Department of Environmental Quality.
[3] Eight chloride-36AMS analyses were delayed from the 3rd quarter, 2005 and are combined with the 1st quarter, 2006 results.
[4] Analyzing quality control samples at a rate of approximately 5 to 10 percent of the total number of analyses performed for the year is deemed appropriate for the DEQ-INL ESP.
[5] Data usability rate [total analyses – rejected data]/[total analyses] of 90 percent or higher is acceptable for the DEQ-INL ESP.

Table 24. Blank analysis results for gross alpha and beta in particulate air (TSP) for the first quarter, 2006. Concentrations[1] and associated uncertainties (2 SD) are expressed in 1 x 10^{-3} pCi/m^3.

Collection Period		Corrected volume (m^3) [1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
12/29/05	01/05/06	1728	0.0	0.2	-0.3	0.3
01/05/06	01/12/06	1728	-0.4	0.2	-0.6	0.3
01/12/06	01/19/06	1728	-0.2	0.2	-0.3	0.3
01/19/06	01/26/06	1728	-0.3	0.2	-0.4	0.3
01/26/06	02/02/06	1728	-0.1	0.2	0.1	0.3
02/02/06	02/09/06	1728	0.0	0.2	-0.3	0.3
02/09/06	02/16/06	1728	-0.2	0.2	-0.3	0.3
02/16/06	02/23/06	1728	-0.1	0.2	-0.2	0.3
02/23/06	03/02/06	1728	-0.2	0.2	-0.1	0.3
03/02/06	03/09/06	1728	-0.1	0.2	-0.3	0.3
03/09/06	03/16/06	1728	0.1	0.3	0.4	0.4
03/16/06	03/23/06	1728	0.0	0.2	-0.1	0.3
03/23/06	03/30/06	1728	0.2	0.2	-0.1	0.3

[1] A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters.

Table 25. Blank analysis results for gamma spectroscopy for TSP particulate air filters for the first quarter, 2006. Concentrations[1] are expressed in 1 x 10^{-5} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Beryllium-7			Ruthenium-106/ Rhodium-106			Antimony-125		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
04/17/06	-7	32	55	-45	39	69	-2	9	15

[1] These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.

Table 25 continued. Blank analysis results for gamma spectroscopy for TSP particulate air filters for the first quarter, 2006. Concentrations[1] are expressed in 1x10^{-5} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Cesium-134			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
04/17/06	1	4	7	2	4	7

[1] These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.

Table 26. Blank analysis results for radiochemical analysis data for TSP particulate air filters composited for 2005. Concentrations[1] are expressed in $1x10^{-5}$ pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Strontium-90			Plutonium-238		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
04/06	0.09	1.12	2.11	0.00	0.00	0.08

[1] These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar year. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters.

Table 26 continued. Blank analysis results for radiochemical analysis data for TSP particulate air filters composited for 2005. Concentrations[1] are expressed in $1x10^{-5}$ pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Plutonium-239/240			Americium-241		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
04/06	0.01	0.07	0.17	0.02	0.08	0.17

[1] These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar year. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters.

Table 27. Blank analysis results for tritium water vapor from air samples for the first quarter, 2006. Concentrations are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP061ZTR01	01/18/06	01/19/06	04/27/06	0.01	0.08	0.13
OP061ZTR02	02/23/06	03/01/06	04/27/06	-0.02	0.08	0.14
OP061ZTR03	03/13/06	04/06/06	04/27/06	-0.03	0.08	0.13
OP061ZTR04	03/13/06	04/12/06	04/27/06	-0.05	0.07	0.13
1Q06 Sink	12/30/05	04/06/06	04/27/06	0.01	0.08	0.13

Table 28. Blank analysis results for cesium-137, potassium-40, tritium, enriched tritium, gross alpha, and gross beta in ground and surface water samples for the first quarter, 2006. Concentrations are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC). NR = Analysis not requested.

Sample Number	Cesium-137			Tritium			Enriched Tritium			Gross Alpha			Gross Beta		
	Concentration	±2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
061W017	0.0	1.5	2.6	NR	-	-	NR	-	-	-0.2	0.6	1.0	0.0	0.8	1.3
061W018	NR	-	-	40	80	140	25	6	9	NR	-	-	NR	-	-

Table 29. Duplicate radiological analysis results (in pCi/L) for ground and surface water, first quarter, 2006.

Analysis/ Sample Location	Original Sample Number	Analysis Date	Concentration	± 2 SD	Duplicate Sample Number	Analysis Date	Concentration	± 2 SD	$/R_1-R_2/$	$3(s_1^2+s_2^2)^{1/2}$	Within Criteria?[1]
Gross Alpha											
Mud Lake Water Supply	061W011	03/16/06	-0.4	1.4	061W015	03/16/06	1.2	1.4	1.6	5.9	Yes
Gross Beta											
Mud Lake Water Supply	061W011	03/16/06	4.2	1.0	061W015	03/16/06	4.8	1.0	0.6	4.2	Yes
Gamma Spectroscopy Cesium-137											
Mud Lake Water Supply	061W011	02/21/06	-0.3	1.7	061W015	02/23/06	0.2	2.3	0.5	8.6	Yes
Tritium											
Mud Lake Water Supply	061W012	03/16/06	-20	80	061W016	03/20/06	-70	80	50	339.4	Yes
Enriched Tritium											
Mud Lake Water Supply	061W012	04/21/06	1	5	061W016	04/24/06	3	6	2	23.4	Yes

[1] $/R_1-R_2/ \leq 3(s_1^2+s_2^2)^{1/2}$

Table 30. Electret ionization chamber irradiation results (categorized as spiked samples) for first quarter, 2006. A percent recovery (%R) of 100 ± 25 is considered acceptable.

Electret #	Exposure Received		Gross Measured Exposure		Background[1]		Net Exposure[2]		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty[3] (mR)	
S1	27.0	1.35	31.4	1.40	3.8	0.70	27.6	1.57	102.3%
S2	27.0	1.35	33.0	1.38	3.8	0.70	29.2	1.55	108.4%
S3	27.0	1.35	32.0	1.32	3.8	0.70	28.2	1.50	104.7%
S4	27.0	1.35	32.1	1.37	3.8	0.70	28.3	1.54	105.0%
S5	45.0	2.25	58.5	1.37	3.8	0.70	54.7	1.54	121.6%
S6	45.0	2.25	55.0	1.38	3.8	0.70	51.2	1.55	113.9%
S7	45.0	2.25	55.1	1.40	3.8	0.70	51.3	1.56	114.1%
S8	45.0	2.25	57.6	1.36	3.8	0.70	53.8	1.53	119.7%

[1] Four EICs were used for control measurements (counted as blanks) and were not irradiated. Background exposure ± 1 SD, as measured by the control group, was 3.8 ± 0.70 mR.
[2] [Gross Measured Exposure] – [Background].
[3] Total propagated error.

Table 31. Air sampling field equipment service reliability (percent operational) for first quarter 2006. These values were calculated by dividing the number of weeks the equipment was in operation by the number of weeks in the quarter.

Station Locations	Sample Type[1]			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100%	100%	100%	100%
Experimental Field Station	92%	100%	100%	NC
Sand Dunes Tower	100%	100%	100%	NC
Van Buren Avenue	100%	100%	100%	NC
Boundary Locations				
Atomic City	100%	100%	100%	100%
Howe	100%	100%	100%	100%
Monteview	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%
Distant Locations				
Craters of the Moon	100%	100%	100%	NC
Idaho Falls	100%	100%	100%	100%

[1] NC = sample not collected at this location.

Appendix A

Table A-1. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2006.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Rest Area	12/29/05	01/05/06	0.0	0.2	6.5	0.6
	01/05/06	01/12/06	0.0	0.3	18.7	1.0
	01/12/06	01/19/06	0.5	0.3	16.8	1.2
	01/19/06	01/26/06	0.3	0.3	25.6	1.4
	01/26/06	02/02/06	0.4	0.2	19.7	1.0
	02/02/06	02/09/06	0.6	0.3	23.8	1.4
	02/09/06	02/16/06	0.7	0.3	33.4	1.3
	02/16/06	02/23/06	0.7	0.3	43.5	1.5
	02/23/06	03/02/06	0.6	0.3	31.2	1.2
	03/02/06	03/09/06	0.4	0.3	14.1	0.9
	03/09/06	03/16/06	0.3	0.2	16.2	0.9
	03/16/06	03/23/06	0.7	0.3	23.5	1.1
	03/23/06	03/30/06	0.8	0.3	22.9	1.1
Experimental Field Station	12/29/05	01/05/06	0.0	0.2	6.3	0.7
	01/05/06	01/12/06	0.1	0.3	21.9	1.1
	01/12/06	01/19/06	0.6	0.3	16.8	1.0
	01/19/06	01/26/06	0.4	0.3	25.6	1.2
	01/26/06	02/02/06	0.3	0.2	23.1	1.1
	02/02/06	02/09/06	0.5	0.3	25.1	1.2
	02/09/06	02/16/06	0.8	0.3	37.9	1.4
	02/16/06	02/23/06	1.0	0.3	53.0	1.7
	02/23/06	03/02/06	0.8	0.3	32.3	1.3
	03/02/06	03/09/06	0.3	0.3	12.4	1.1
	03/09/06	03/16/06	NS[2]		NS[2]	
	03/16/06	03/23/06	0.3	0.2	18.6	1.0
	03/23/06	03/30/06	0.5	0.2	19.0	1.0

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2006.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	12/29/05	01/05/06	0.2	0.2	6.7	0.6
	01/05/06	01/12/06	0.0	0.3	27.3	1.2
	01/12/06	01/19/06	0.2	0.2	18.2	1.0
	01/19/06	01/26/06	0.3	0.2	27.9	1.2
	01/26/06	02/02/06	0.8	0.3	27.9	1.2
	02/02/06	02/09/06	0.4	0.2	25.3	1.1
	02/09/06	02/16/06	0.8	0.3	36.0	1.3
	02/16/06	02/23/06	0.7	0.3	51.3	1.6
	02/23/06	03/02/06	0.9	0.3	36.3	1.3
	03/02/06	03/09/06	0.4	0.3	12.1	0.8
	03/09/06	03/16/06	0.4	0.3	16.7	0.9
	03/16/06	03/23/06	0.4	0.2	21.8	1.0
	03/23/06	03/30/06	0.7	0.2	21.0	1.0
Van Buren	12/29/05	01/05/06	0.2	0.2	6.7	0.7
	01/05/06	01/12/06	0.1	0.3	17.8	1.2
	01/12/06	01/19/06	0.3	0.3	16.0	0.9
	01/19/06	01/26/06	0.3	0.3	24.8	1.4
	01/26/06	02/02/06	0.4	0.2	17.6	1.0
	02/02/06	02/09/06	0.6	0.3	22.7	1.1
	02/09/06	02/16/06	0.5	0.3	32.6	1.3
	02/16/06	02/23/06	0.9	0.3	43.5	1.5
	02/23/06	03/02/06	0.8	0.3	30.6	1.2
	03/02/06	03/09/06	0.3	0.3	12.8	0.9
	03/09/06	03/16/06	0.4	0.3	14.8	0.9
	03/16/06	03/23/06	0.5	0.3	20.8	1.0
	03/23/06	03/30/06	0.6	0.3	21.9	1.1
Atomic City	12/29/05	01/05/06	-0.1	0.2	6.6	0.7
	01/05/06	01/12/06	0.1	0.3	19.5	1.0
	01/12/06	01/19/06	0.2	0.2	14.9	0.9
	01/19/06	01/26/06	0.4	0.3	28.2	1.2
	01/26/06	02/02/06	0.6	0.3	14.7	0.9
	02/02/06	02/09/06	0.2	0.2	25.2	1.1
	02/09/06	02/16/06	0.5	0.3	36.4	1.4
	02/16/06	02/23/06	0.9	0.3	37.6	1.4
	02/23/06	03/02/06	0.8	0.3	34.6	1.3
	03/02/06	03/09/06	0.3	0.3	13.6	0.9
	03/09/06	03/16/06	0.5	0.3	14.5	0.9
	03/16/06	03/23/06	0.6	0.3	20.5	1.0
	03/23/06	03/30/06	0.8	0.3	25.1	1.3

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2006.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	12/29/05	01/05/06	0.1	0.2	5.9	0.6
	01/05/06	01/12/06	0.0	0.3	19.3	1.0
	01/12/06	01/19/06	0.7	0.4	16.0	1.2
	01/19/06	01/26/06	0.3	0.3	24.7	1.4
	01/26/06	02/02/06	0.5	0.3	24.3	1.1
	02/02/06	02/09/06	0.3	0.2	18.9	1.0
	02/09/06	02/16/06	1.1	0.3	35.9	1.3
	02/16/06	02/23/06	0.6	0.3	48.3	1.5
	02/23/06	03/02/06	0.7	0.3	31.2	1.5
	03/02/06	03/09/06	0.2	0.2	11.4	0.8
	03/09/06	03/16/06	0.4	0.3	15.4	0.9
	03/16/06	03/23/06	0.7	0.3	19.7	1.0
	03/23/06	03/30/06	0.6	0.2	21.1	1.1
Monteview	12/29/05	01/05/06	0.2	0.2	7.0	0.7
	01/05/06	01/12/06	0.4	0.3	25.5	1.1
	01/12/06	01/19/06	0.1	0.2	12.8	0.8
	01/19/06	01/26/06	0.5	0.3	22.1	1.1
	01/26/06	02/02/06	0.6	0.3	27.3	1.2
	02/02/06	02/09/06	0.4	0.2	20.0	1.0
	02/09/06	02/16/06	0.7	0.3	28.1	1.2
	02/16/06	02/23/06	1.0	0.3	45.1	1.5
	02/23/06	03/02/06	0.7	0.3	29.8	1.2
	03/02/06	03/09/06	0.1	0.2	11.4	0.8
	03/09/06	03/16/06	0.2	0.2	15.1	0.9
	03/16/06	03/23/06	0.7	0.3	19.6	1.0
	03/23/06	03/30/06	0.6	0.2	21.6	1.1
Mud Lake	12/29/05	01/05/06	0.1	0.2	6.1	0.6
	01/05/06	01/12/06	0.3	0.3	23.3	1.1
	01/12/06	01/19/06	0.3	0.2	14.3	0.9
	01/19/06	01/26/06	0.2	0.2	24.5	1.1
	01/26/06	02/02/06	0.6	0.3	26.4	1.1
	02/02/06	02/09/06	0.4	0.2	20.9	1.0
	02/09/06	02/16/06	0.9	0.3	34.5	1.3
	02/16/06	02/23/06	1.3	0.3	45.4	1.5
	02/23/06	03/02/06	0.9	0.3	34.6	1.3
	03/02/06	03/09/06	0.4	0.2	9.7	0.7
	03/09/06	03/16/06	0.7	0.3	15.0	0.9
	03/16/06	03/23/06	0.6	0.3	20.4	1.0
	03/23/06	03/30/06	0.5	0.2	20.8	1.0

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2006.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters	12/29/05	01/05/06	0.2	0.2	4.5	0.6
	01/05/06	01/12/06	-0.2	0.2	10.7	0.8
	01/12/06	01/19/06	0.1	0.2	8.3	0.7
	01/19/06	01/26/06	0.4	0.2	16.5	0.9
	01/26/06	02/02/06	0.1	0.2	10.3	0.8
	02/02/06	02/09/06	0.5	0.3	14.4	0.9
	02/09/06	02/16/06	1.0	0.3	29.0	1.2
	02/16/06	02/23/06	0.4	0.2	32.0	1.3
	02/23/06	03/02/06	0.8	0.3	23.0	1.1
	03/02/06	03/09/06	0.1	0.2	9.3	0.8
	03/09/06	03/16/06	0.3	0.2	11.8	0.8
	03/16/06	03/23/06	0.6	0.3	16.8	0.9
	03/23/06	03/30/06	0.8	0.3	14.2	0.9
Fort Hall[1]	12/29/05	01/05/06	0.3	0.3	5.2	0.7
	01/05/06	01/12/06	0.3	0.3	15.7	0.9
	01/12/06	01/19/06	0.3	0.3	7.7	0.7
	01/19/06	01/26/06	1.1	0.3	16.4	1.0
	01/26/06	02/02/06	0.8	0.5	20.5	1.5
	02/02/06	02/09/06	0.8	0.3	14.1	0.9
	02/09/06	02/16/06	1.5	0.3	25.2	1.2
	02/16/06	02/23/06	1.6	0.3	27.2	1.2
	02/23/06	03/02/06	1.3	0.3	25.2	1.1
	03/02/06	03/09/06	0.6	0.3	9.9	0.8
	03/09/06	03/16/06	0.3	0.2	11.7	0.8
	03/16/06	03/23/06	0.3	0.2	14.7	0.9
	03/23/06	03/30/06	0.5	0.2	17.0	1.0
Idaho Falls	12/29/05	01/05/06	0.1	0.2	5.9	0.6
	01/05/06	01/12/06	0.2	0.2	17.8	0.9
	01/12/06	01/19/06	0.3	0.2	11.0	0.8
	01/19/06	01/26/06	0.4	0.2	20.7	1.0
	01/26/06	02/02/06	0.2	0.2	15.4	0.8
	02/02/06	02/09/06	0.4	0.2	18.1	0.9
	02/09/06	02/16/06	1.0	0.3	30.6	1.2
	02/16/06	02/23/06	0.6	0.2	35.6	1.3
	02/23/06	03/02/06	1.1	0.3	29.0	1.1
	03/02/06	03/09/06	0.4	0.2	12.6	0.8
	03/09/06	03/16/06	0.5	0.3	14.6	0.9
	03/16/06	03/23/06	0.5	0.2	17.1	0.9
	03/23/06	03/30/06	0.7	0.2	17.6	0.9

[1] Operated by Shoshone-Bannock Tribes.
[2] No sample due to equipment failure.

Appendix B

Table B-1. Results for additional electret locations, first quarter, 2006.

Sample Location	Net Corrected Exposure (μR/h)	± 2 SD (μR/h)
Arco	14.2	2.9
Taber	14.8	1.4
Blackfoot	11.6	3.6
Howe Met. Tower	10.8	3.1
MP276 -20	11.7	2.7
MP274 -20	12.1	1.7
MP272 -20	13.0	2.7
MP270 -20	13.3	3.9
MP268 -20	13.4	2.8
MP266 -20	13.0	5.9
MP264 -20	13.7	0.2
MP270 -20/26	14.9	0.9
MP268 -20/26	13.9	3.5
MP266 -20/26	13.8	3.1
MP263 -20/26	13.2	4.5
MP261 -20/26	14.3	3.6
MP259 -20/26	13.1	1.0
EBR II	15.3	3.4
EBR I	14.1	2.0
RWMC	13.4	3.1
CFA	15.5	1.9
PBF	15.4	2.6
MP1 -Lincoln Blvd	17.4	0.2
ICPPI	16.4	2.2
TRA	14.2	3.2
Grid 3	14.4	0.9
MP5 -Lincoln Blvd	16.6	1.6
MP7 -Lincoln Blvd	15.9	4.2
NRF	15.8	1.4
MP9 -Lincoln Blvd	15.3	3.1
MP11 -Lincoln Blvd	15.9	5.6
MP13 -Lincoln Blvd	18.0	10.6
Mp15 -Lincoln Blvd	15.1	1.5
MP17 -Lincoln Blvd	14.5	0.9

[1] No sample, electret lost

Table B-1 continued. Results for additional electret locations, first quarter, 2006.

Sample Location	Net Corrected Exposure (µR/h)	± 2 SD (µR/h)
MP19 -Lincoln Blvd	13.7	4.0
MP21 -Lincoln Blvd	16.0	1.9
TAN	16.5	2.4
Mud Lake Bank of Commerce	13.5	2.5
MP43-33	15.7	3.1
MP41-33	15.7	3.7
MP39-33	16.0	4.1
MP37-33	12.4	5.0
MP35-33	16.1	1.3
MP33-33	16.2	2.7
MP31-33	15.5	4.0
MP29-33	15.0	2.2
MP27-33	14.9	1.3
MP25-33	16.0	4.2
MP23-33	13.7	2.5
Howe Fence-line 1.4 mi	12.3	4.3
Howe Fence-line 2.3 mi	NS[1]	
Howe Fence-line 4.2 mi	14.7	3.3
Howe Fence-line 6.5 mi	14.5	2.7
Howe Fence-line 8.6 mi	14.0	1.0
Howe Fence-line 9.7 mi	14.1	2.9
MP9 -22/33	14.1	2.9
MP7 -22/33	11.3	3.6
MP5 -22/33	14.0	3.4
MP3 -22/33	13.3	3.1
MP1 -22/33	13.6	4.6
Rover Rd. 2.9 mi	13.2	2.1
Rover Rd. 4.9 mi	15.0	0.6
Rover Rd. 6.3 mi	13.5	4.9
Rover Rd. 6.8 mi	14.4	2.9
Rover Rd. 8.8 mi	13.1	0.9
Rover Rd. 10.8 mi	17.2	3.0
Rover Rd. 15.4 mi	18.2	6.4
Rover Rd. 17.4 mi	17.3	9.4
Dubois	10.9	4.2
Hamer	15.1	4.1
Sugar City	16.1	5.1

[1] No sample, electret lost

Table B-1 continued. Results for additional electret locations, first quarter, 2006.

Sample Location	Net Corrected Exposure (µR/h)	± 2 SD (µR/h)
Roberts	12.3	21.8
Blue Dome	12.0	4.0
Reno Ranch	12.5	0.9
Kettle Butte	13.4	3.4
Aberdeen	11.8	2.8
Minidoka	11.4	1.8
Richfield	10.5	3.1

[1] No sample, electret lost

Appendix C

Table C-1. List of volatile organic compounds (VOCs) analyzed for water verification samples, first quarter, 2006. Minimum detectable concentrations (MDC) are expressed in µg/L.

Analyte	MDC
Benzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
1,4-Dichlorobenzene	0.5
1,2-Dichlorobenzene	0.5
1,2-Dichloroethane	0.5
1,1-Dichloroethene	0.5
cis-1,2-Dichloroethene	0.5
trans-1,2-Dichloroethene	0.5
1,2-Dichloropropane	0.5
Ethylbenzene	0.5
Methylene Chloride	0.5
Styrene	0.5
Tetrachloroethylene (PERC)	0.5
Toluene	0.5
1,2,4-Trichlorobenzene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethylene	0.5
Vinyl chloride	0.5
Xylenes (total)	0.5
Bromodichloromethane	0.5
Dibromochloromethane	0.5
Bromoform	0.5
Chloroform	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromomethane	0.5
n-Butylbenzene	0.5
sec-Butylbenzene	0.5
tert-Butylbenzene	0.5
Chloroethane	0.5
Chloromethane	0.5
2-Chlorotoluene	0.5
4-Chlorotoluene	0.5
1,2-Dibromo-3-chloropropane (DBCP)	1.0
1,2-Dibromoethane (EDB)	0.5

Table C-1 continued. List of volatile organic compounds (VOCs) analyzed for water verification samples, first quarter, 2006. Minimum detectable concentrations (MDC) are expressed in µg/L.

Analyte	MDC
Dibromomethane	0.5
1,3-Dichlorobenzene	0.5
Dichlorodifluoromethane	0.5
1,1-Dichloroethane	0.5
1,3-Dichloropropane	0.5
2,2-Dichloropropane	0.5
1,1-Dichloropropene	0.5
cis-1,3-Dichloropropene	0.5
trans-1,3-Dichloropropene	0.5
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
p-Isopropyltoluene	0.5
Methyl Tert Butyl Ether (MTBE)	1.0
Naphthalene	1.0
n-Propylbenzene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,2,3-Trichlorobenzene	1.25
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	0.5
1,3,5-Trimethylbenzene	0.5